# 3D ENGINEERING IN MIDDLE AND HIGH SCHOOL


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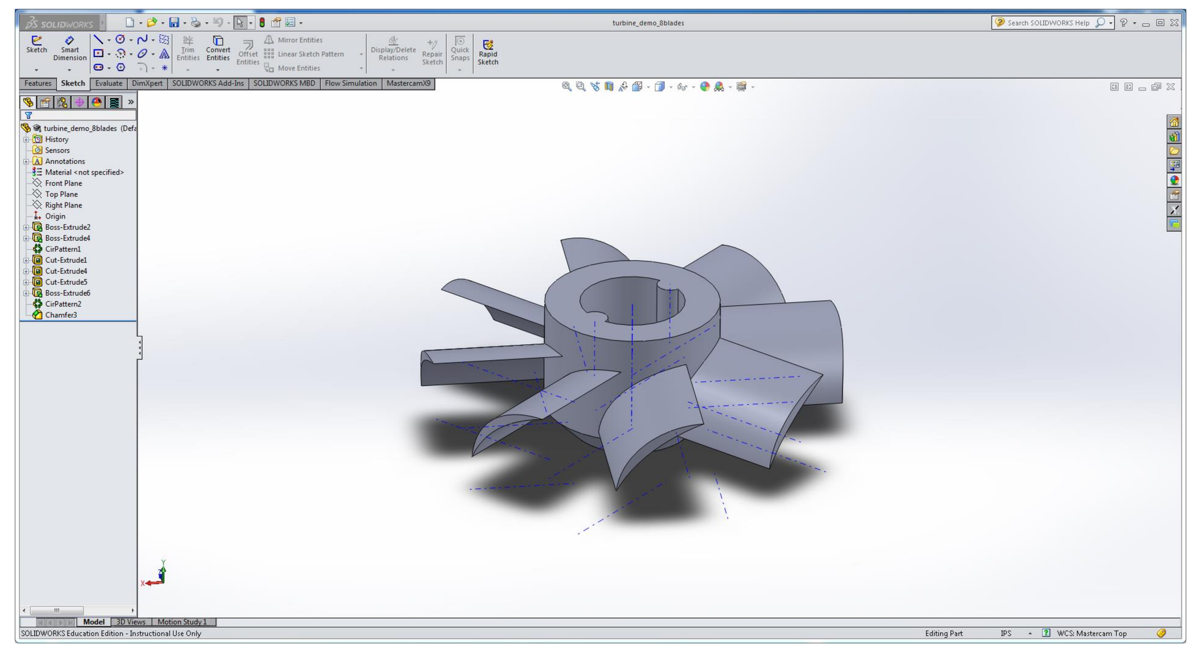
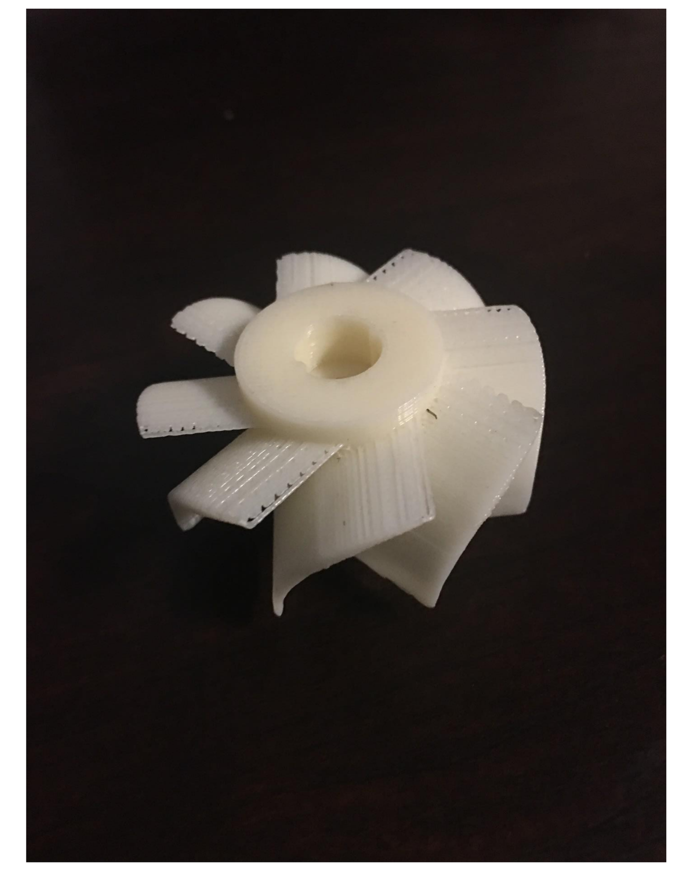
## Overview

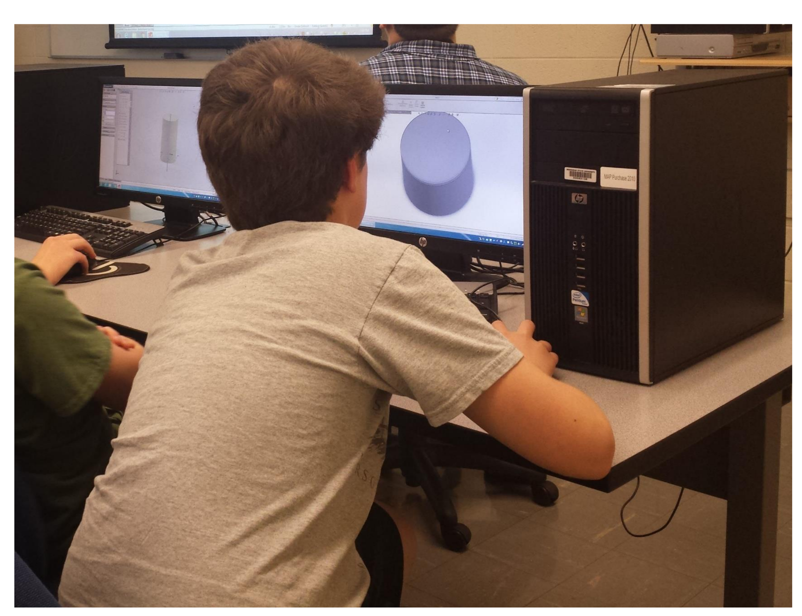
Hydroelectric power, also known as hydropower, is utilized throughout the world, particularly in South America, Europe, and British Columbia, Canada (Pelto, 2011). Most hydropower energy produced in the United States is generated in the Pacific Northwest, and about 13% of the renewable energy in the United States originates from hydropower. Based on work produced by Lent, Brown, and Hackett (1994), our research investigates how engineering education, facilitated via a hydropower project, can effect the perception of middle and secondary students of a career in engineering and/or technology.

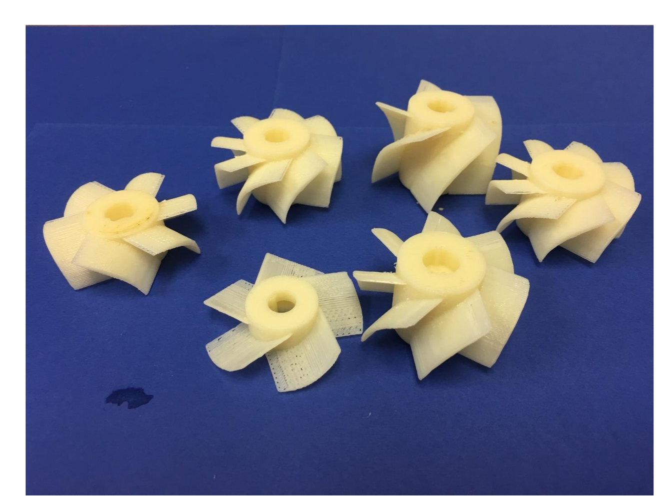
## Methodology

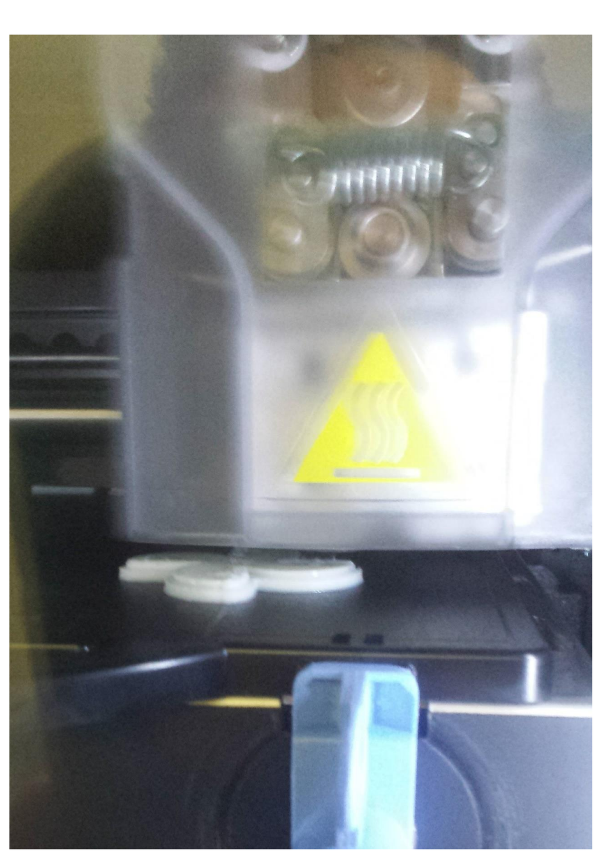
This project was implemented in two stages. For the first stage, middle and secondary students used SolidWorks® Educational Edition, a 3D modelling software, to design propeller-style water turbines. The students were given basic instructional tutorials in order to be able to design the turbines. The project allowed the students to make unique turbines with different pitch, size, number of blades, shape, and scoping of blades.
In between the design stage and the test stage, the students' turbines were printed using a Stratasys 250mc 3D printer.
For the second stage, students tested their turbines using water flow.





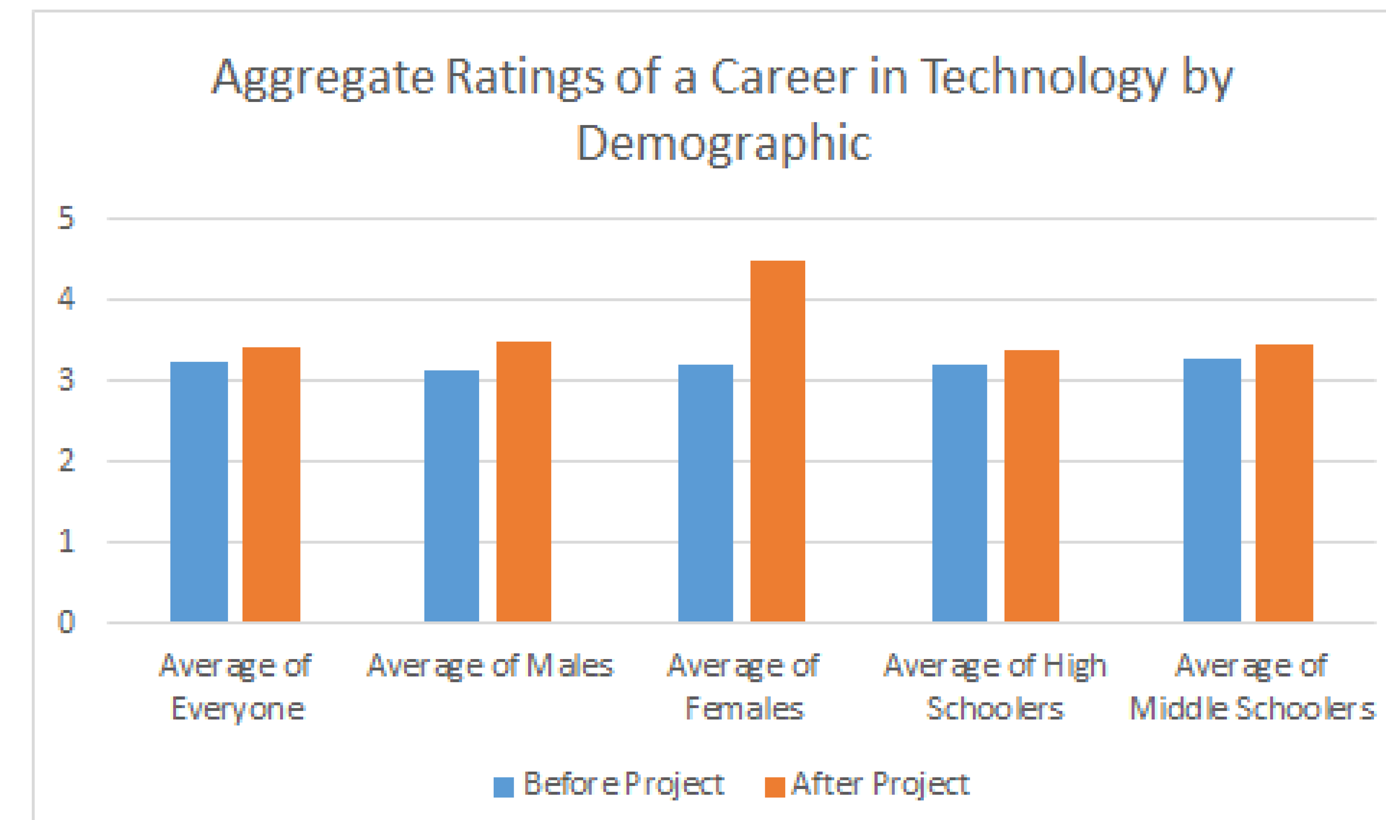


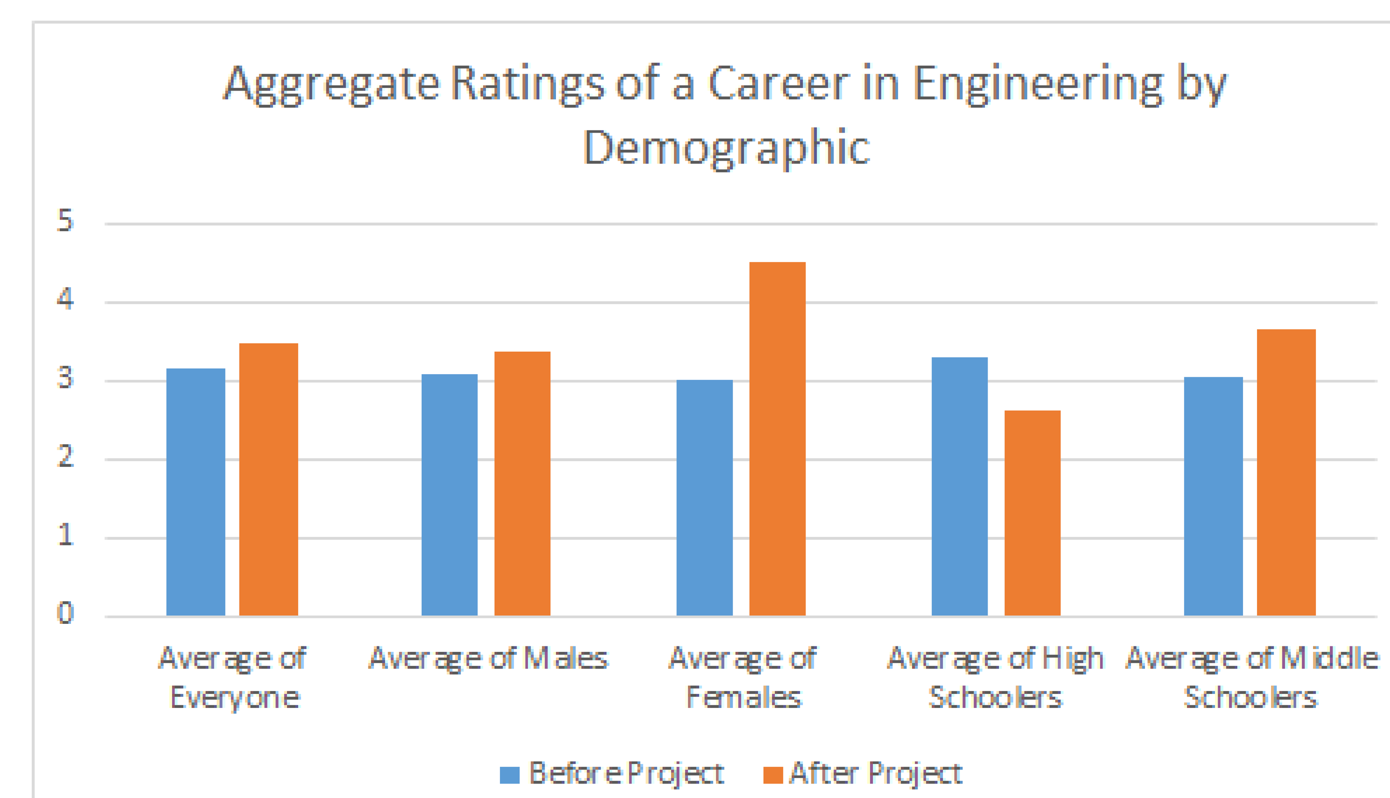




## Results

The students were asked to answer questions based on different adjectives, like "exciting" and "interesting," and how they felt each one applied to their perceptions of technology and engineering on a 1-5 scale. The responses were aggregated into one score on the charts below.




QR code to access additional photo and video from the project

## Further Reading


Bandura, A. (1977). Self-efficacy: toward a unifying theory of behavioral change. Psychological Review, 84(2), pp. 191-215.

Grubbs, M., and Deck, A. (October 2015). The water turbine: an integrative STEM education context, Technology and Engineering Teacher, pp 26-30.

Lent, R., Brown, S., and Hackett, G. (1994). Toward a unifying social cognitive theory of career and academic interest, choice, and performance. Journal of Vocational Behavior, 45(1), pp. 79-122.

Mamaril, N. (2014). Measuring Undergraduate Students' Engineering Self-Efficacy: A Scale Validation Study, Doctoral Dissertation. Lexington, KY: University of Kentucky.

Pelto, M. (2011). Glaciers and hydropower, retrieved October 1, 2016 from http://www.nichols.edu/departments/glacier/glacier%20runoff%20hydropower.htm